

# Update on NC State's NUC Activities

*Yousry Y. Azmy*  
Distinguished Professor  
Department of Nuclear Engineering  
North Carolina State University



# NUC Workshops at NCSU

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## ❑ **Cybersecurity for Nuclear Power:**

- ❖ INL leads: Ginger Wright & Steve Hartenstein
- ❖ NCSU lead: ?
- ❖ Date: TBD

## ❑ **Multiphysics Model Validation:**

- ❖ INL lead: Hans Gougar
- ❖ NCSU leads: Maria Avramova, Kostadin Ivanov, Nam Dinh
- ❖ Date: June 2017



# NEKVAC Workshop on Verification & Validation of Multi-Physics Tools

## ❑ Sponsor: INL subcontract to NCSU

- ❖ Knowledge Management Comm of Nuclear Energy Knowledge & Validation Center (NEKVAC)

## ❑ One-week on-campus workshop:

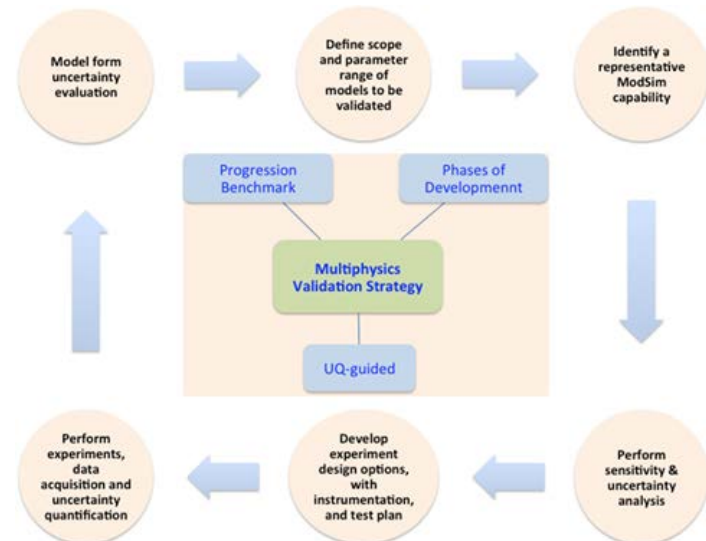
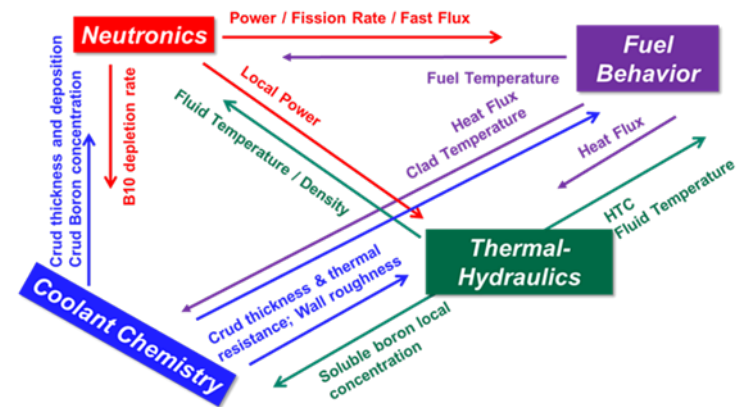
- ❖ Conducted by Drs. M. Avramova (lead), K. Ivanov, and N. Dinh

## ❑ Target – young professionals at:

- ❖ Industry
- ❖ Regulator & government agencies
- ❖ National laboratories
- ❖ Graduate students & post-docs

## ❑ Purpose:

- ❖ Understanding of concepts, principles & procedures for V&V of traditional & novel multi-physics M&S



# Engagements with INL

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- ❑ **INL new leadership team visit: May 3 (and 4?) 2017**
- ❑ **Shannon Bragg-Sitton (INL) Adjunct Prof of Nuclear Eng:**
  - ❖ Serve on PhD Comms of Daniel Mikkelson & Konor Frick (Doster)
- ❑ ***Big Idea* proposed by OSU & NCSU: Advanced Fast Test Reactor**
  - ❖ Wade & I requested y'all input: your university's capabilities to contribute to proposal/project if NUC is invited
- ❑ **Nuclear security connection:**
  - ❖ Interviews about to start for JFA with ORNL in this area
  - ❖ DNN preproposal missed opportunity
  - ❖ Meeting with INL's new leader of this area: Zachary Tudor?
- ❑ **Six NEUP proposals invited, some with INL involvement**



# Student Affairs

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## □ Progress towards degree:

- ❖ Payel Chatterjee (NUC-intern, Spring 2016) Earned PhD Fall 2016 (Gupta)
- ❖ Daniel Mikkelson (LDRD-supported) passed PhD QE last semester (Doster)
- ❖ Konor Frick (NEUP Fellow) completed MS on NHES last summer (Doster)
  - Also passed PhD QE & will take Prelim Exam this semester
- ❖ Corey Misenheimer passed PhD Prelim Exam this week (Terry)
  - Expected to finish PhD this summer
- ❖ Fola Odeniyi completed her MS in summer (Terry):
  - Topic: compressed air HES (not funded by LDRD \$)



# Papers Published & Presented

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- ❖ Konor Frick & J. Michael Doster, “Design of a Thermal Energy Storage System for SMR’s,” *Trans. Amer. Nucl. Soc.* **114**, 111 (2016) – presented in ANS New Orleans
- ❖ J. Michael Doster & Konor L. Frick, “Coupling of Thermal Energy Storage with Small Modular Reactors,” *Trans. Amer. Nucl. Soc.* **115**, 387 (2016) – presented in ANS Las Vegas
- ❖ C.T. Misenheimer & S.D. Terry, “Modeling Hybrid Nuclear Systems with Chilled Water” *ASME Journal of Energy Resources and Technology* **139**, January 2017



# Papers Accepted for Publication

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- ❑ **Accepted for publication & presentation at NPIC & NMIT 2017 ANS Topical Meeting in San Francisco, June 2017:**
  - ❖ Corey Misenheimer, Stephen Terry, J. Michael Doster and Shannon Bragg-Sitton, “Analysis of a Nuclear Hybrid Energy System Using Absorption Chillers and Stratified Chilled Water Storage with an mPower Reactor”
  - ❖ Konor Frick, J. Michael Doster and Shannon Bragg-Sitton, “Control Strategies for Coupling Thermal Energy Storage Systems with Small Modular Reactors”



# Big Idea

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**Advanced Fast Test Reactor (AFTR) – Co-leads Wade Marcum and Yousry Azmy:** In recent years there has been renewed interest among a broad range of constituents to construct a new experimental reactor in the US, with either a testing or demonstration mission. Some effort was invested by DOE-NE in a planning study for an Advanced Test and/or Demonstration Reactor (AT/DR) that was ordered by Congress (see Oct 6, 2015 report by NEAC's Nuclear Reactor Technology (NRT) Subcommittee on AT/DR Planning Study). Construction of a fast reactor at INL for testing purposes will accomplish several objectives:

- 1) Complement the thermal testing capabilities currently available at the ATR.
- 2) Enable a continuous source of fast flux testing currently not available in the US.
- 3) Provide INL with a modern world class facility on par with ORNL's SNS that has complimentary, but unique capabilities.
- 4) Enhance INL's image as a science-oriented laboratory by facilitating new science to its own staff and attracting top scientists and engineers from around the world to conduct experiments in AFTR.

Much deliberation must go into the conceptual and the actual design of the reactor but based on previous studies we believe a fast reactor fills a clear and relevant existing gap in infrastructural needs. With careful design and potentially ingenious engineering the facility may also provide large-volume thermal-flux testing that would benefit advanced LWR fuels research. The proposed idea will require the combined efforts of multiple universities and laboratories whose direction will be coordinated by NUC and INL, respectively, to achieve the desired purpose. We envision substantial engagement by students, both from within and without NUC, in this effort. These students will “grow” into professionals who will run and manage the AFTR for the remainder of their careers with the benefit of having seen it through the various stages of its design and construction. As pointed out in NRT's report one major challenge to a project of this nature is creating sustainable funding and organizational structures to keep up the facility, however INL has an established record in this regard that ultimately mitigates this concern, given the strong university-laboratory consortium that is already in-place.

